

IN THE CLAIMS:

The text of all pending claims is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strike through~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

Please AMEND claims 18, 20, 22, and 25 in accordance with the following:

1. (Previously Presented) A wavelength division multiplexing optical transmission system, in which each signal light with different wavelengths output from a plurality of optical senders is multiplexed by an optical multiplexer to be transmitted to an optical transmission path, and wavelength division multiplexing signal light propagated through the optical transmission path is demultiplexed depending on respective wavelengths by an optical demultiplexer to be received by a plurality of optical receivers,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type, and

wherein when it is assumed that the equation model expressing the transmission characteristics of said optical multiplexer and said optical demultiplexer is expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f , the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order "n"

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f / 2} \right)^{2n} \right\} \right] \quad (\text{dB})$$

each of said plurality of optical senders generates signal light in which a bit rate and frequency spacing thereof are set so as to approach spectrum efficiency at which the product of a transmission distance and a transmission capacity becomes a maximum value, said product being calculated based on the assumed equation model, and

wherein said optical multiplexer and said optical demultiplexer have transmission characteristics in which transmission bandwidth is set in accordance with said equation model, and also according to the spectrum efficiency at which the product of the transmission distance and the transmission capacity becomes a maximum value.

2. (Canceled)

3. (Previously Presented) A wavelength division multiplexing optical transmission system according to claim 1,

wherein said filter order "n" is secondary, and the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is 0.574bit/s/Hz.

4. (Original) A wavelength division multiplexing optical transmission system according to claim 3,

wherein, when the bit rate B and frequency grid I per one wave of the signal light are given in advance, a natural number "k" is selected so as to minimize a difference between the spectrum efficiency $B/(kl)$ where "k" is the natural number, and the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value, so that frequency spacing $S=kl$, of the signal light is set in accordance with the natural number "k".

5. (Original) A wavelength division multiplexing optical transmission system according to claim 4,

wherein, when a value B/I obtained by dividing said bit rate B by said frequency grid I is 1.6 to 2.0bit/s/Hz, 3 is selected as said natural number "k".

6. (Original) A wavelength division multiplexing optical transmission system according to claim 5,

wherein, when 40 to 50Gbit/s is given as said bit rate B, and 25GHz interval is given as said frequency grid I, frequency spacing is set to 75GHz.

7. (Original) A wavelength division multiplexing optical transmission system according to claim 4,

wherein, when a value B/I obtained by dividing said bit rate B by said frequency grid I is 1.6bit/s/Hz, and 3 is selected as said natural number "k",

said optical multiplexer and said optical demultiplexer have transmission characteristics following said equation model in which said filter order "n" is 1.2 or more.

8. (Original) A wavelength division multiplexing optical transmission system according to claim 7,

wherein said optical multiplexer and said optical demultiplexer have transmission characteristics in which a value $\Delta f/f_b$ obtained by dividing full width at half maximum Δf of said transmission band by a clock frequency f_b of the signal light, is within a range of 1.50 to 1.90.

9. (Original) A wavelength division multiplexing optical transmission system according to claim 4,

wherein, when a value B/I obtained by dividing said bit rate B by said frequency grid I is 1.7bit/s/Hz, and 3 is selected as said natural number "k",

said optical multiplexer and said optical demultiplexer have transmission characteristics following said equation model in which said filter order "n" is 1.5 or more.

10. (Original) A wavelength division multiplexing optical transmission system according to claim 9,

wherein said optical multiplexer and said optical demultiplexer have transmission characteristics in which a value $\Delta f/f_b$ obtained by dividing full width at half maximum Δf of said transmission band by a clock frequency f_b of the signal light, is within a range of 1.45 to 1.95.

11. (Original) A wavelength division multiplexing optical transmission system according to claim 4,

wherein, when a value B/I obtained by dividing said bit rate B by said frequency grid I is 2.0bit/s/Hz, and 3 is selected as said natural number "k",

said optical multiplexer and said optical demultiplexer have transmission characteristics following said equation model in which said filter order "n" is 2 or more.

12. (Original) A wavelength division multiplexing optical transmission system according to claim 11,

wherein said optical multiplexer and said optical demultiplexer have transmission characteristics in which a value $\Delta f/f_b$ obtained by dividing full width at half maximum Δf of said transmission band by a clock frequency f_b of the signal light, is within a range of 1.35 to 1.70.

13. (Original) A wavelength division multiplexing optical transmission system according to claim 1,

wherein each of said optical multiplexer and said optical demultiplexer is constituted using an arrayed waveguide grating.

14. (Original) A wavelength division multiplexing optical transmission system according to claim 1,

wherein each of said optical multiplexer and said optical demultiplexer is constituted by combining an optical interleaver using an interference filter, and an arrayed waveguide grating.

15. (Original) A wavelength division multiplexing optical transmission system according to claim 1,

wherein each of said optical multiplexer and said optical demultiplexer is constituted by combining an optical interleaver using an interference filter, and a dielectric multi-layer film filter.

16. (Original) A wavelength division multiplexing optical transmission system according to claim 1,

wherein the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value is calculated as spectrum efficiency at which a performance index $PI = 10 \cdot (-\Delta Q/10) \cdot B/S$, which is expressed using a Q-value degradation amount ΔQ of the system, a bit rate B and frequency spacing S of the signal light, becomes a maximum value.

17. (Previously Presented) A wavelength division multiplexing optical transmission method of multiplexing a plurality of signal light with different wavelengths to transmit to an optical transmission path, and demultiplexing wavelength division multiplexed signal light propagated through said optical transmission path according to wavelength to receive,

wherein the type modulation of said signal light is determined to be an NRZ modulation type, and

wherein when it is assumed that the equation model expressing the transmission characteristics of said optical multiplexer and said optical demultiplexer is expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f, the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order "n",

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f/2} \right)^{2n} \right\} \right] \quad (\text{dB})$$

spectrum efficiency at which the product of a transmission distance and a transmission capacity becomes a maximum value is calculated based on the assumed equation model, and

wherein a bit rate and frequency spacing of the signal light are set so as to approach the spectrum efficiency at which the product of said transmission distance and said transmission capacity becomes the maximum value, and also actual transmission characteristics at the time of multiplexing and demultiplexing the signal light is set in accordance with said equation model, to transmit the wavelength division multiplexed signal light.

18. (Currently Amended) A wavelength multiplexing apparatus for multiplexing optical signals with a plurality of wavelengths, comprising:

a polarization independent filter having a band narrower than a spectrum width obtained based on a bit rate and a type of coding of each of said optical signals,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type,

wherein said polarization independent filter has transmission characteristics in which transmission bandwidth is set in accordance with the equation model expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f , the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order " n ".

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f/2} \right)^{2n} \right\} \right] \quad (\text{dB})$$

_____, and

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals of the plurality of wavelengths is eliminated by said polarization independent filter, thereby generating a wavelength division multiplexed light in which spacing of said optical signals is made narrower than said spectrum width to be output.

19. (Canceled).

20. (Currently Amended) A wavelength demultiplexing apparatus for demultiplexing wavelength division multiplexed light obtained by multiplexing optical signals with a plurality of wavelengths, comprising:

a polarization independent filter having a band narrower than a spectrum width obtained based on a bit rate and a type of coding of each of said optical signals,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type,

wherein said polarization independent filter has transmission characteristics in which transmission bandwidth is set in accordance with the equation model expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f , the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order "n",

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f/2} \right)^{2n} \right\} \right] \quad (\text{dB})$$

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals is eliminated by said polarization independent filter, thereby demultiplexing optical signals with a plurality of wavelengths in which spacing of said optical signals is made narrower than said spectrum width to be output.

21. (Canceled).

22. (Currently Amended) An optical transmission system including a wavelength multiplexing apparatus for multiplexing optical signals with a plurality of wavelengths, and a wavelength demultiplexing apparatus for demultiplexing wavelength division multiplexed light obtained by multiplexing optical signals with a plurality of wavelengths, wherein each wavelength multiplexing apparatus and wavelength demultiplexing apparatus comprising

a polarization independent filter having a band narrower than a spectrum width obtained based on a bit rate and a type of coding of each of said optical signals,

wherein the type of modulation of said signal light is determined to be an NRZ modulation type,

wherein said polarization independent filter has transmission characteristics in which transmission bandwidth is set in accordance with the equation model expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f , the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order "n",

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f/2} \right)^{2n} \right\} \right] \quad (\text{dB})$$

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals of the plurality of wavelengths is eliminated by said polarization independent filter, thereby, in said wavelength multiplexing apparatus, generating a wavelength division multiplexed light in which spacing of said optical signals is made narrower than said spectrum width to be output, and in said wavelength demultiplexing apparatus, and ~~a wavelength demultiplexing apparatus for demultiplexing wavelength division multiplexed light obtained by multiplexing optical signals with a plurality of wavelengths, comprising:~~

a polarization-independent filter having a band narrower than spectrum width obtained based on a bit rate and a type of coding of each of said optical signals,

wherein each component on a short wavelength side and a long wavelength side of each of said optical signals is eliminated by said polarization independent filter, thereby demultiplexing the optical signals with a the plurality of wavelengths in which spacing of said optical signals is made narrower than said spectrum width to be output.

23-24. (Canceled).

25. (Currently Amended) A method of transmitting multiplexed light signals with different wavelengths through an optical fiber, comprising:

optimizing a transmission characteristic corresponding to each light signal by superimposing a secondary gaussian filter centered on a frequency on of each light signal, which narrows the bandwidth of the light signal before multiplexing the light signals,

wherein an order of the secondary gaussian is such that for a given bit rate and type of coding the product of a transmission distance and a transmission capacity becomes a maximum value the type of modulation of said signal light is determined to be an NRZ modulation type, and

wherein said gaussian filter has transmission characteristics in which transmission bandwidth is set in accordance with the equation model expressed by the following equation in which the shape of each transmission band $T(f)$ corresponding to the wavelength of each signal light is expressed by using a frequency f , the center frequency f_c of the transmission band, full width at half maximum Δf of the transmission band, and a filter order “n”,

$$T(f) = 10 \cdot \log \left[\exp \left\{ -2 \cdot \ln \sqrt{2} \cdot \left(\frac{|f - f_c|}{\Delta f/2} \right)^{2n} \right\} \right] \quad (\text{dB}).$$
